



**State of Arizona**  
**Department of Mines and Mineral Resources**  
1502 West Washington Street, Phoenix, AZ 85007-3210

Telephone: 602/771-1600 • Facsimile: 602/771-1616

Toll Free: 1-800-446-4259 in Arizona • [www.mines.az.gov](http://www.mines.az.gov)

**Testimony for The Subcommittee on National Parks, Forests and Public Lands of the Committee on Natural Resources.**

July 21, 2009

Members of the Subcommittee, Ladies and Gentlemen, Good Morning:

My name is Dr. Madan M. Singh and I am Director of the Department of Mines and Mineral Resources, State of Arizona. I have been in this position since August 2005. I have served on five (5) Committees of The National Academies; one in 2007 which resulted in the report entitled “Managing Materials for a 21<sup>st</sup> Century Military.” I have received awards and recognition for my work by my alma mater, The Pennsylvania State University, and the premier mining society in the United States, the Society for Mining, Metallurgy and Exploration, Inc., and was selected as its Distinguished Member in 2004. In 1997, I was elected Fellow of the American Consulting Engineers Council (ACEC) and a Fellow of the American Society of Civil Engineers (ASCE) in 1985. I have chaired six (6) national conferences and have authored over 120 technical publications, many of them peer-reviewed.

This testimony is presented against the withdrawal of the uranium-bearing lands around the Grand Canyon National Park.

The Arizona Strip is the part of the State of Arizona that lies above the Grand Canyon and the Utah border. The Strip occupies a total surface area of 20,404.2 km<sup>2</sup> (7,878.11 mi<sup>2</sup>). Of this, 20,348.12 km<sup>2</sup> (7,856.45 mi<sup>2</sup>) is land, and only 56.08 km<sup>2</sup> (21.653 mi<sup>2</sup>) is water. Its land area comprises 6.9 percent of Arizona's land area. About 64.4 percent of its area is in Mohave County and 35.6 percent in Coconino County. The region is typical of the Colorado Plateau with an arid climate and sagebrush vegetation. The Kaibab National Forest also is being considered for withdrawal and these remarks apply equally to that area. A significant part of the area is already withdrawn from mineral entry:

**National Monuments**

**Grand Canyon-Parashant** – Covers an area of 4,115 km<sup>2</sup> (1,017,000 acres); about 81 km<sup>2</sup> (20,000 acres) within Lake Mead National Recreation Area. It was established by Presidential Proclamation 7265 on January 11, 2000. There are no paved roads into the monument and no visitor services.

**Pipe Spring** –Comprises an area of 0.16 km<sup>2</sup> (40 acres), and was established on May 31, 1923. The monument was listed in the National Register of Historic Places on October 15, 1966.

**Vermillion Cliffs** – This 1,189 km<sup>2</sup> (294,000 acre)-monument was established by proclamation on November 9, 2000.

### National Park

**Grand Canyon** – Is one of the oldest national parks, having been established as national monument on January 11, 1908 and designated as a national park on February 26, 1919. It extends over 4,927 km<sup>2</sup> (1,902 mi<sup>2</sup>) and is considered one the natural wonders of the world, the gorge of the Colorado River.

### National Recreation Areas

**Glenn Canyon** – Covers 5,076 km<sup>2</sup> (1,254,429 acres) of primarily desert land surrounding Lake Powell. A part of the recreation area is in Utah. It was established in 1972.

**Lake Mead** – The area was established as the Boulder Dam Recreation Area on October 31, 1936 but the name was changed to Lake Mead Recreation Area on August 11, 1947. It covers 6,053 km<sup>2</sup> (1,495,665.69 acres) with water over 756 km<sup>2</sup> (186,000 acres). Nearly 81 km<sup>2</sup> (20,000 acres) overlaps the Grand Canyon-Parashant National Monument. A small portion is in Nevada.

### Wilderness Areas

**Beaver Dam Mountains** – The wilderness area, designated as such in 1984, comprises 71 km<sup>2</sup> (17,600 acres) of which 61 km<sup>2</sup> (15,000 acres) lies in Arizona and the rest in Utah.

**Grand Walsh Cliffs** – Occupies 323 km<sup>2</sup> (37,030 acres), selected as a wilderness in 1984.

**Kanab Creek** – Covers 305 km<sup>2</sup> (75,300 acres) and was established in 1984.

**Mount Trumbull** – Was also established in 1984 and comprises 31 km<sup>2</sup> (7,880 acres).

**Mount Logan** – Occupies 59 km<sup>2</sup> (14,650 acres) and was designated as a wilderness in 1984.

**Paiute** – Has witnessed very little incursion by humans and covers 356 km<sup>2</sup> (87,900 acres); chosen to be a wilderness in 1984.

**Paria Canyon-Vermillion Cliffs** – Established on August 28, 1984 and occupies 455 km<sup>2</sup> (112,500 acres); partly in Utah.

It should be noted that all of the above wilderness areas were established in 1984. This was the result of the Arizona Wilderness Act of 1984, which had been negotiated during 1983 and 1984 between various environmental groups, industry, and other stakeholders. It was agreed at that time that the areas designated in the bill as wilderness would be removed from mineral entry, but

that the remaining areas would remain open to multiple use. Senators McCain (then Congressman and party to the discussions) and Kyl have written a letter (Attachment 1) to Representative Grijalva stating this to be the case. Senators DeConcini and Hatch (who were also involved in the negotiations at the time) have written to Secretary Salazar, outlining the results of those meetings (Attachment 2). Thus it seems that the sections of the Arizona Strip not specifically withdrawn as noted above were to remain open to mineral entry. A Resolution adopted by the Board of Supervisors of Mohave County supporting the mining of uranium on the Strip is also attached (Attachment 3).

Currently over 55.6% of the total area of the State of Arizona is already withdrawn from mineral exploration and mining. The State is fortunate enough to be blessed with considerable mineral wealth. According to the U.S. Geological Survey Arizona was the No. 1 non-fuel mineral producing state in the country in 2008. However, continual withdrawal of land from mining is depriving the state of revenues that it direly needs, and the country of necessary raw materials.

In recognition of this fact the Arizona Legislature has recently passed HCM 2006 (Attachment 4) requesting Congress to refrain from enacting any legislation that affects Arizona public lands.

### **Economic Impact**

Mohave County has an area of 34,886 km<sup>2</sup> (13,470 mi<sup>2</sup>) and had an estimated population of 196,281 in 2008. The median household income in 2007 was \$39,669 compared with \$49,923 for the State of Arizona. In the county, 13.5% of the persons were living below the poverty line. The household income figure for Fredonia, the largest town, is \$39,295; the per capita income is \$17,616 and it is even lower in the rural areas. For Kanab, Utah, across the border, the comparative figures are \$43,025 and \$20,153 respectively. The average household income for Utah in 2007 was \$55,109. Coconino County had an estimated population of 128,558 in 2008. The median household income was \$48,546 in 2007, and 16.2% of the population lived below the poverty line. The county is spread over 48,332 km<sup>2</sup> (18,661 mi<sup>2</sup>). The income for miners in the area varies between \$60,000 and \$80,000 per annum.

The occurrence of breccias pipes, which may host uranium deposits, make it possible to operate mines with a footprint of 10 to 20 acres. The mines are small and generally are in production for about two years. There may be a year of pre-production activity and then there is dismantling and reclamation. During the 1980s and early 1990s there were seven mines in operation in the area. These have now been reclaimed so well that it is difficult to locate them without prior knowledge of their existence.

According to U. S. Geological Survey estimates (USGS Circular 1051) there are probably 375 million pounds of yellowcake (uranium oxide, U<sub>3</sub>O<sub>8</sub>) in the area that is to be removed from mining by H.R.644. This result was based on work performed in 1987, when the presence of the breccia pipes was only detected by their visibility on the surface. Recently some mineralized pipes have been located by geophysical means that are not evident on the surface. So it is

probable that the amount of uranium present is greater. The ore from these pipes have an average grade above 0.6% which is the highest grade ore in the United States. Even if we accept the 375-million pound figure this is the equivalent of 27 billion kilowatt-hours of electricity. At the present rate of generation, this could replace all the power generated by coal plants in the United States for a decade. Another way to look at this – it is the equivalent of 13.3 billion barrels of oil. That is the total amount of recoverable oil in the Prudhoe Bay oilfield, the largest in the U.S. At a price of \$50 per pound of  $U_3O_8$ , this resource is worth \$18.75 billion.

Based on a recent study conducted by Tetra Tech, Inc., there will be approximately six (6) mines in operation at any one time with another six (6) being reclaimed over roughly a 20-year period. These mines will generate an average of 552 direct jobs and another 432 indirect jobs, primarily in the service sector. The average wages for miners was \$65,741 in 2008. The direct construction costs will range from \$2.97 billion to \$3.67 billion; the indirect impact will range from \$2.13 billion to \$2.63 billion. Thus the total economic impacts will be from \$5.06 billion to \$6.29 billion during the construction period. During the mine operation period there will be 366 direct and 646 indirect jobs resulting in 1,012 new jobs in the community. The total economic will range between \$23.53 billion and \$29.41 billion, that is, \$1.31 billion to \$1.34 billion annually. Some of the jobs may be for persons residing in Kane or San Juan Counties in Utah, in which case the impact on Mohave and Coconino Counties in Arizona will be reduced somewhat. The tax implications for Federal, state, and local governments is estimated to be \$360 million per year, or \$7 billion for the two-decade period under consideration.

The ore that is produced from the mines is planned to be trucked to the White Mesa Mill in Blanding, Utah. The mill employs 150 persons, which implies an economic impact of \$2.9 billion to San Juan County, Utah and the surrounding communities. However the shipping will benefit trucking companies in the vicinity and generate \$1.01 billion for the local area.

### **Environmental Considerations and Safety**

Since the ore is transported to Blanding, Utah there will no local impact from the tailings. The rock from the shaft and other excavations for the mine will be poured back into the openings after the ore has been removed. Without tailings, there will be no dust problems that would be a concern. The surface facilities and roads are removed, and the sites reclaimed.

It should be mentioned that the Arizona Department of Environmental Quality will investigate the mining operations before they issue any permits, as will all the other state and Federal agencies that are involved. This includes the U.S. Nuclear Regulatory Commission. The operations are fully permitted in compliance with State and Federal regulations and bonded to ensure reclamation.

Nuclear power plants produce no air pollutants such as sulfur, mercury, greenhouse gases, or particulates. Dr. El-Baradei, Director General of the International Atomic Energy Agency and Nobel laureate, has stated (2005), “Nuclear power emits virtually no greenhouse gases. The

complete nuclear power chain, from uranium mining to waste disposal, and including reactor and facility construction, emits only two to six grams of carbon per kilowatt-hour. This is about two orders of magnitude below coal, oil, and even natural gas.”

A few environmental groups claim, without providing any scientific supporting data, that the groundwater of the Redwall-Muav aquifer and the Colorado River would be contaminated by uranium mining. The occurrence of the uranium deposits in the breccias pipes is a few hundred feet below the surface and generally about 1,000 feet above the aquifer, separated by the impermeable Supai formation. Hence there is little chance of the water being contaminated.

The area in question, as mentioned above is desert; the annual precipitation varies from 20 inches at the higher elevations to 12 inches in the low regions. The area where the mining will be is in the low section. There is little runoff to be concerned about, however the operators ensure that no water gets off the mine property, and all of it is contained in a lined pond.

Based on USGS data for November 1990 and June 1991, published in 1996 (USGS OFR 96-614), the Colorado River water enters and leaves the mineralized breccia zone at uranium concentration of between 4 and 5 parts per billion (ppb). This level continues to decrease as it goes down the river. The EPA safe drinking water concentration is 30 ppb – so the level is significantly lower! It is worth noting that the average concentration of uranium in the Colorado River is 4.6 ppb, lower than that of fresh water in an arid region, which is 5.0 ppb.

Water taken in a two-week period in April and May 1991 from a well in the Redwall-Muav aquifer near the Kanab North Mine, which was in operation at the time, had uranium concentrations between 0.8 and 5.9 ppb; again much lower than the safe drinking water level.

Modeling of the groundwater during its transitory passage through the Orphan Mine, which was mined prior to its inclusion in the National Park, contributes very small amounts of uranium to the Redwall-Muav aquifer and the Colorado River compared to the mineral existing in the river and the aquifer. Data accumulated by the USGS and others indicate that the springs around the mineralized breccia pipes in proximity to the rim of the Grand Canyon contribute insignificant amounts of uranium to the Colorado River because the flow rates from the springs is very low. This also applies to Horn Creek, the spring closest to the historic Orphan Mine. It is safe to conclude that springs further away from the River, beyond even the boundaries of the National Park, would have even less impact on the waters of the Colorado River and would not pose any health hazard to the people using the water.

Dr. Charles Sanchez and Dr. John T. Chesley at the University of Arizona, and Dr. Yemane Asmerom at the University of New Mexico, with funding from the Arizona Water Sustainability Program and agricultural interests, have used isotopic methodologies along with elemental analysis to study metal contamination sources in Colorado River water. The methodology utilized is relatively new, but can help discriminate between natural and anthropogenic input. It can directly target anthropogenic sources such as mining or it can be used (as was done for

uranium by the investigators) to suggest that the source of uranium observed in the Colorado River in their study is not from mining activity. Based on the preliminary results to date for a single set of samples along the Colorado River from 2007, Drs. Sanchez, Chesley and Asmerom state: "Although we did not sample on a spatial scale to rule out temporary local contamination, or on a temporal scale to rule out transitory plumes, the isotope data (uranium, strontium, and lead) in the main channel of the Colorado River are generally consistent with the normal weathering of uranium containing geomedial within the area of interest and rule against major contamination from uranium mines or tailings." As a minimum the study has established a baseline to which longer term studies of potential uranium contamination in the Colorado River can be evaluated. As well, studies such as these may allow us to separate "real" contamination issues from "perceived" contamination.

USGS Open File Report OFR-89-550 shows the location of 1,296 breccia pipes. More than 400 of these pipes occur within the boundaries of the Grand Canyon National Park; of these an estimated 30 to 50 are probably mineralized (that is, uranium bearing). Water passing through these, because of erosion, is flowing into the Colorado River, even though these have never been touched by mining. One of these pipes, approximately three miles from the Park Service Phantom Ranch lodge, shows high grade uranium mineralization at the surface. All of these have not affected the number of visitors coming to the Park.

A major concern in the mining of uranium is safety and radiation exposure. In general the impacts of mining uranium are not much different than other mining. Natural uranium ore is about as radioactive as the granite countertops that many people have in their kitchens. The risk comes from the associated radon gas and radium. Since this is now well understood, mining companies protect the workers with excellent ventilation. Epidemiological studies have established that the risk of lung cancer among smokers is between 10 and 20 times higher than with persons who have never smoked. The industry appreciates this risk and does not permit smoking.

It should also be remembered that the industry now has over half a century of experience with uranium mining and has adopted internationally recognized standards. The radiation safety regulations used in the United States, Australia, and Canada are the most comprehensive and stringent in the world, and the radiation doses are well within the regulatory limits. Uranium mines are probably the most highly regulated industrial operations in the world; both by state and Federal agencies. Frequent inspections ensure that employees and environment are duly protected. The industry has long accepted that it is much more efficient to prevent pollution than to remediate it later.

Everyone receives small amounts of radiation from natural sources such as cosmic radiation, rocks, soil, and air. Uranium mining does not increase this noticeably for the surrounding communities and the public at large. The objective of the nuclear industry – from mines to

reactors – is to control and limit the release of potentially harmful substances into the environment.

### **Supply and Demand**

Over 92 percent of the uranium required for the nuclear plants in the United States is imported, a significant amount of that from Russia. A part of this comes from the decommissioning of nuclear warheads in accordance with the START treaties. Russia has stated that it will not supply this secondary uranium beyond 2012. This source is dwindling from all countries. The demand for the fuel will expand in the future, especially with the emphasis on control of greenhouse gases. China, for example plans to increase the power from nuclear plants from 9 gigawatts per year at the present to 75 gigawatts by 2020. Other countries, such Russia, India, and other Asian nations are also increasing the capacity for power from this source. There are 436 reactors in operation in the world; another 433 are in development or on the drawing boards. It is evident that the demand for uranium will be strong in the coming years.

At this time 64 percent of the uranium is being mined from just eight mines. This makes the supply prone to disruptions. The flooding of Cigar Lake mine in Canada, which is now expected to become operational in 2014, and the delays in the Olympic Dam project in Australia, which will be commissioned with increased production in 2016, serve as examples of the type of setbacks that may be expected. These are two of the larger mines.

Recently China has made an agreement with Australia to buy uranium from it; even though there is the danger of China diverting some of it for military purposes. In Kazakhstan, JSC Atomredmetzoloto (ARMZ) has agreed to acquire 16.6 percent of Uranium One, for a stake in its Karatau mine; this could rise up to 19.95 percent in the next five years. ARMZ will take 50 percent of the production from Karatau or 20 percent of Uranium One's total production, whichever is larger. Uranium One's partner in Karatau will be Kazatomprom, a Kazakh state-owned company. The money for the deal comes from a Japanese consortium, which has the option to purchase 20 percent of Uranium One's production. This appears to provide Uranium One with strategic partners in Russia, Japan, and Kazakhstan. However, it may be recalled that Kazakhstan's president recently arrested the president of Kazatomprom on charges of improper uranium sales. These are just a couple of examples of the control that foreign companies and countries are now exerting over uranium deposits worldwide.

This also points to the importance of obtaining the mineral domestically from a national and homeland security viewpoint.

### **Other Concerns**

There is concern about uranium mining because of the legacy of mining left by mining of the mineral during the 1940s for the war effort. It should be borne in mind that the dangers associated with uranium were not well understood at the time. Persons were permitted to watch

atomic blasts without protective gear and seamen were ordered to scrub the decks of ships after test were conducted in the atolls. “Fiesta ware” was openly sold and watches with radium dials were worn with pride. Significantly, the formations that contained the uranium were quite different, as was the mining practice. The government was more interested in obtaining the uranium and provided incentives that encouraged lack of safety. The contracts were suddenly terminated when the need declined. Those circumstances do not apply to the contemplated mining in the Arizona Strip. Mining in the 1980s and early 1990s in the region has shown that there was no damage to the environment and the miners have not been injured or wronged in any manner.

The number of claims in the Strip have also been used to create an atmosphere of trepidation among the general public. Every claim does not imply the existence of breccia pipes in it and every pipe does not signify that there is even mineralization in it. Further, the amount of minerals has to be economically workable. Historically, only 1 to 5 percent of the breccia pipes are sufficiently mineralized to be mined profitably. Both the discovery and marketability criteria need to be met to establish the validity of a claim.

It may be mentioned that there are currently 104 reactors in operation in the United States, the largest number in any country in the world. Nuclear reactors have also been used in the Navy, in ships and submarines, for the last 60 years. There has been only one accident, Three Mile Island (TMI), in all that time; even at TMI there was no significant release or fatality. Thus, the use of nuclear power is probably the safest and most environmentally appropriate; even Mr. Patrick Moore, the co-founder of Greenpeace has advocated its use. For that to continue, uranium is required for fuel. The Arizona Strip provides the richest source of domestic uranium. It would serve the nation best if this was permitted to be mined.

Thank you for the opportunity to present my remarks today.